What is claimed is:

1. A method for assessing oxygenation in a tissue, the method comprising the steps of:

(A) providing a tissue;

(B) introducing to the tissue a contrast agent comprising surface modified hemoglobin;

(C) placing the tissue in a magnetic field and irradiating the tissue with radio frequency energy; and

(D) determining spin-lattice and spin-spin relaxation times of water protons associated with oxygenated and deoxygenated states of the hemoglobin in the tissues; thereby,

determining the oxygenation in the tissue.

2. The method of claim 1, further comprising the step (E) of comparing the spin-lattice or the spin-spin relaxation times of the oxygenated and the deoxygenated states of the hemoglobin to assess tissue oxygenation.

3. The method of claim 1, further comprising the step (E) of extrapolating the spin-lattice and spin-spin relaxation times of water protons to generate an image correlated with tissue oxygenation levels.

4. The method of claim 1, wherein a molecule to modify the surface of hemoglobin comprises any one or more: polyethylene glycol (PEG), s-nitrosylated PEG (SNO-PEG); nucleophilic PEGs, carboxyl PEGs, electrophilically activated PEGs, sulfhydryl-selective PEGs, heterofunctional PEGs, biotin PEGs, vinyl derivatives, PEG silanes or PEG phospholipids.

5. The method of claim 1, wherein the hemoglobin surface comprises molecules comprising pyridoxal phosphate, alpha-carboxymethyl, or omega-carboxymethoxyl polyoxyethylene (POE).

6. The method of claim 1, wherein the contrast agent provides a ρ_1 of at least about $0.5x10^6$ $(s*mM)^{-1}$ or a ρ_2 of at least about $1x10^6$ $(s*mM)^{-1}$ at a field strength of about 1.5 T on a per particle basis.

7. A method of determining oxygenation in a patient, the method comprising:

administering to the patient a contrast agent comprising surface modified hemoglobin;

subjecting the patient to a magnetic field and irradiating the patient with radio frequency energy; and

determining spin-lattice and spin-spin relaxation times of water protons associated with oxygenated and deoxygenated states of the hemoglobin in the patient; thereby,

determining the oxygenation levels in the patient.

8. The method of claim 7, further comprising the step of comparing the spin-lattice or the spin-spin relaxation times of the oxygenated and the deoxygenated states of the hemoglobin to assess oxygenation.

9. The method of claim 7, further comprising the step of extrapolating the spin-lattice and spin-spin relaxation times of water protons to generate an image correlated with tissue oxygenation levels.

10. The method of claim 7, wherein a molecule to modify the surface of hemoglobin comprises any one or more: polyethylene glycol (PEG), s-nitrosylated PEG (SNO-PEG); nucleophilic PEGs, carboxyl PEGs, electrophilically activated PEGs, sulfhydryl-selective PEGs, heterofunctional PEGs, biotin PEGs, vinyl derivatives, PEG silanes or PEG phospholipids.

11. The method of claim 7, wherein the hemoglobin surface comprises molecules comprising pyridoxal phosphate, alpha-carboxymethyl, or omega-carboxymethoxyl polyoxyethylene (POE).

12. The method of claim 7, wherein the contrast agent provides a ρ_1 of at least about $0.5x10^6$ $(s*mM)^{-1}$ or a ρ_2 of at least about $1x10^6$ $(s*mM)^{-1}$ at a field strength of about 1.5 T on a per particle basis.

13. The method of claim 7, wherein the contrast agent optionally comprises proteins, glycoproteins, polysaccharides or targeting ligands.

14. The method of claim 7, wherein surface (surfactants) coating molecules are cross-linked.

15. The method of claim 14, wherein surfactant coating molecules comprise at least one compound selected from the group consisting of: proteins, glycoproteins, polysaccharides, a natural phospholipid, a synthetic phospholipid, a fatty acid, a cholesterol, a lysolipid, a sphingomyelin, a tocopherol, a glucolipid, a stearylamine, a cardiolipin, a lipid with an ether-linker fatty acid, a lipid with an ester linked fatty acid, a polymerized lipid, and a polyethylene glycol-conjugated lipid.

17. The method of claim 7, wherein the PEG is attached to the hemoglobin with a linker.

18. The method of claim 7, wherein the linker is an alkyl, amide, carbamate or phenyl group.

19. The method of claim 7, wherein the linker is an unsaturated aliphatic or aromatic C_1 to C_6 moiety.

20. The method of claim 7, wherein the patient is suffering from traumatic injury.

21. The method of claim 7, wherein the contrast agent oxygenation levels of cell foci is diagnostic of a tumor.

22. The method of claim 21, wherein the cell foci have a low oxygenation level.

23. The method of claim 7, wherein localized low oxygenation levels are diagnostic of internal injuries.

24. The method of claim 7, wherein the hemoglobin source is mammalian.

25. The method of claim 7, wherein the patient is an animal.

26 The method of claim 7, wherein the animal is a human being.

27 A contrast agent comprising an inert core, surfactant and paramagnetic ion.

28. The contrast agent of claim 27, wherein the inert core is a blood substitute, perfluorocarbon compound or a mixture of fluorocarbons and oils.

29. The contrast agent of claim 27, wherein the contrast agent further comprises a paramagnetic ion is selected from the group consisting of scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, molybdenum, ruthenium, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, and ytterbium.

30. The agent of claim 27, wherein the surfactant coating is cross-linked.

31. The contrast agent of claim 27, wherein the surfactant coating comprises at least one compound selected from the group consisting of a natural phospholipid, a synthetic phospholipid, a fatty acid, a cholesterol, a lysolipid, a sphingomyelin, a tocopherol, a glucolipid, a stearylamine, a cardiolipin, a lipid with an ether-linker fatty acid, a lipid with an ester linked fatty acid, a polymerized lipid, and a polyethylene glycol-conjugated lipid.